Double-wall tube and die for extruding the same

Patent number: GB994567
Publication date: 1965-06-10
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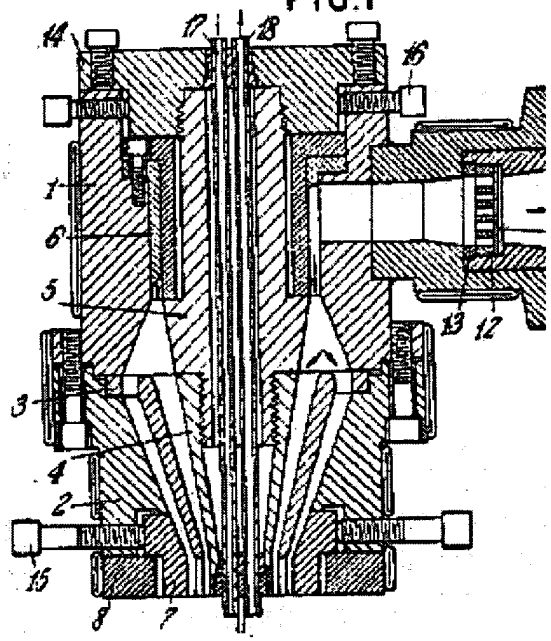
Classification:
- international:
- european: B29C47/20E; B29C47/28; B29C47/70B; F16L9/18
Application number: GB19640017948 19640430
Priority number(s): GB19640017948 19640430

Abstract of **GB994567**

994,567. Extension dies. GOSUDARST- VENNY NAUCHNO ISSLEDOVATELSKY INSTITUTE PLASTIC-HESKYKH MASS. April 30, 1964, No. 17948/64. Heading B5A. [Also in Division F2] A double-walled tube of plastics material having substantially concentric internal and external walls connected by four symmetrical bridges running the length of the tube is pro- duced by extrusion through a die comprising a two-part axial mandrel 4, 5 a surrounding coaxial bushing 3 and a housing 2 surrounding the bushing, annular channels of decreasing cross-sectional area in the direction of extrusion being defined between the mandrel 4 and bush- ing 3, and the bushing 3 and housing 2, the mouth of the bushing having a cylindrical portion with axial slots therein to provide for the formation of said bridges during simul- taneous plastics extrusion down both of said annular channels. Material to be extruded passes through filter screens 11 and grate 12 from the extruder to the cross-head die. The wall thickness of the outer tubing is controlled by an adjustable outer die member plate 7 and of the inner tubing by adjusting the axial position of the mandrel 5. Cooling means 17, 18 for the inner tube are provided, the outer tube being cooled and sized in the conventional manner.

FIG.1



D uble-wall tube and die f r extruding the same

Description of **GB994567**

COMPLETE SPECIFICATION
Double-Wall Tube and Die for Extrudingthe Same
wes GOSUDARSTVENNY NAUCHNO-ISSLEDO
VATELSKY INSTITUTEPtASTICEIESKYIH MASS, a Body Corporate of the Union of Soviet
Socialist Republics (U.S.S.R.), of Moscow,
Perovsky proezd 35, U.S.S.R., do hereby declare the invention, for which we pray that a patent may be granted t
us, and the method by which it is to be performed, to be particularly described in and by the followingstatement:
This invention relates to a die for extruding double-wall plastic tubes of the "tubein-tube" type.

Conventional double-wall thermoplastic tubes are arranged concentric to each other and interconnected by one bridge. These tubes are normally used for delivering liquid to a device and discharging the waste therefroml. The tubes may be somewhat unsatisfactorywhen used at low temperatures since, due to the low heat resistance of thermoplastic materials, any tubes containing frozen liquids cannot be heated up by a torch flame.

Should it be necessary toconvev a number of liquids to the device and discharge them therefrom, each liquid, or a least each pair of liquids may require a separate tube, which will involve the use of much material. For handling liquids at high pressures, the low strength of plastics materials may necessitate walls of a considerable thickness which increases the weight of the tube and the consumption of plastics material,whilst the extrusion ofthick-wallec tubes presents cooling problems in tube-producing equipment due to the poor heat conductivity of plastics materi

In one aspect, this invention consists in an extruded plastics material double-wall tube having substantially concentric internal and external walls interconnected by a plurality of bridges,preferably foursymmetrically-positioned bridges, running the length of the tube.

The tube of this invention enables more than two liquids or gases to be conveyed at the same time, or a fluid conveyed in the inner bore may be heated or cooled by a fluid in the outer bore.

This invention also consists in a die for extruding a tube referred to in the last but one paragraph, the die compris an axial mandrel, a coaxial bushing surrounding the mandrel and a housing surrounding the bushing, annular channels of cross-sectional area decreasing in the direction of the mouth of the die being defined between the mandrel and bushing and between the bushing and housing, and the mouth of the bushing having a cylindrical portion with axial slots therein arranged to provide said bridges during simultaneous extrusion of plastics material passing down both said annular channels.

Preferably, the mandrel, both surfaces of the bushing and the internal surface of the housing all taper down in the direction of the mouth of the die, all of them having a cylindrical portion adjacent to the mouth of the die.

The tapered bushing may be mounted on the housing by means of a breaker integral with the bushing.

The cross-sectional area of the annular channelsmay decrease by decreasing the radial thickness or the radius, c both, of the annular channels in the direction of the mouth of the die.

Part of the housing may be formed by an adjustable outer die member arranged to control the thickness of the outside wall of the tube, and the axial position of the mandrel may be adjustable to control the thickness of the ins wall of the tube.

In the die of this invention. suitable cooling means may be arranged without any difficulty. Thus a cooling fluid ma be passed down the centre of the mandrel in order to cool the inside of the internal wall of the tube.

The invention will be further described, by way of example, with reference to the accompanying drawings, ofwhicl
Figure 1 is a longitudinal section of an extruder die;
Figure 2 is across-section of a tube produced by the die;

Figure 3 is a longitudinal section of the breaker of the die; and
Figure 4 is a top view of the breaker.

The die has a housing with an upper part 1 and a lower part 2 with a breaker 3 fitted therein and made integral wi circular tapered bushing, the bushing after its tapered portion changing into the form of a cylinder with a number c apertures; a mandrel also composed of two interconnected parts, an upper part 5 and a lower part 4, is mounted as to be displaceable alongthe axis of the housing. The upper part of the die accommodates a bushing 6 for guidi the fused material; the lower portion accommodates an outer die member 7 and a lock ring 8. The die is secured the extruder by means of a bushing 9 and an interim bushing 10 in which are fitted filter screens 11, a grate 12 ar lock ring 13. The upper part of the die is provided with a cover 14.

The outside tube is sized by known sizing attachments. The transverse die for producing double-wall tubes is connected to the extruder by the bushing 9.

The fused material from the extruder passes through the filter screens 11 and the grate 12, and is led to the breal 3 by the bushing 6. The fused material then passes down through the apertures in the breaker 3 and between the mandrel part 4 and the tapered bushing, and reaches the circular grooves at the outlet of the die, finally forming tl two concentric tubes. The thickness of the walls of the outside tube can be controlled by adjusting the position of outer die member plate 7 using screws 15, whereas the thickness of the inside tube can be controlled by adjustin the position of the mandrel parts 4, 5 using screws 16.

The bridges between the tubes are produced by the apertures in the lower cylindrical portion of the tapered bushi

Sizing and cooling of the outside tube is performed using an outside sizing die and applying vacuum and cooling baths. The inside tube is also provided with a cooling system consisting of pipes 17 and 18.

Double-wall plastics tubes produced by action of the extruder die may be used, in particular, for conveying cold o hot liquid, the outside wall and the air spacing between the walls serving as insulation.

The space between the inside and outside walls, divided by the bridges, may be utilized for pumping either hot lic to heat any liquid frozen in the innertube, or cold liquid to prevent the liquid conveyed in the inside tube from becoming over-heated.

It should be noted that the double-wall of the bridged-connected tubes increases the strength of the tube, whilst n necessarily increasing the consumption of the plastics material. The increase in the tube strength is partly due to availability of the two additional cooled or pressure bearing surfaces; in the case of the conventional single-wall tu the outside and inside surfaces perform the work, whereas in the case of the doublewall tube, there are four smo surfaces for taking the load caused by hydrostatic pressure insidethl tube.

WHAT WE CLAIMIS : -
1. An extruded plastics material double-wall tube having substantially concentric internal and external walls interconnected by aplurality of bridges running the length of the tube.

2. A tube as claimed in claim 1 having foursymmetrically-positioned bridges.

3. A die forextruding a tube as claimed in either claim 1 or claim 2, comprising an axial mandrel, a coaxial bushin surrounding the mandrel, and a housing surrounding the bushing, annular channels of cross-sectional area decreasing in the direction of the mouth of the die being defined between the mandrel and bushing, and between bushing and housing, and themouth of the bushing having a cylindrical portion with axial slots therein arranged to provide said bridges during simultaneous extrusion of plastics material passing down both said annular channels.

4. A die as claimed in claim 3 wherein the bushing ismounted on the housing by means of a breaker integral with bushing.

5. A die as claimed in either claim 3 or claim 4 wherein the radial thickness of each annular channel decreases in direction of the mouth of the die.

6. A die asclaimed in any one of claims 3-5 wherein the radius of each annular channel decreases in the directior the mouth of the die.

7. A die as claimed in any one of claims 3-6 wherein part of the housing is formed by an adjustable outer die member plate arranged to control the thickness of the outside wall of the tube.

8. A die as claimed in any one of claims 3-7wherein the axial position of the mandrel is adjustable to control the thickness of the inside wall of the tube.

9. A tube which has been formed substantially as herein described with reference to, and as shown in, the accompanying drawings.

WARNING end of DESC field may overlap start of CLMS **.

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Claims of **GB994567**

WARNING start of CLMS field may overlap end of DESC **.

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Figure 2 is across-section of a tube produced by the die;
Figure 3 is a longitudinal section of the breaker of the die; and
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3. A die forextruding a tube as claimed in either claim 1 or claim 2, comprising an axial mandrel, a coaxial bushin surrounding the mandrel, and a housing surrounding the bushing, annular channels of cross-sectional area

decreasing in the direction of the mouth of the die being defined between the mandrel and bushing, and between bushing and housing, and themouth of the bushing having a cylindrical portion with axial slots therein arranged to provide said bridges during simultaneous extrusion of plastics material passing down both said annular channels.

4. A die as claimed in claim 3 wherein the bushing ismounted on the housing by means of a breaker integral with bushing.

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9. A tube which has been formed substantially as herein described with reference to, and as shown in, the accompanying drawings.

10. A die for extruding tubes, substantially

as herein described with reference to, and as shown in, the accompanying drawings.